3.2 HYDROLOGY

This section is based primarily on site visits and technical data from several engineering studies prepared by Moffatt & Nichol Engineers (M&N); specifically the Ebb Bar and Flood Shoal Study (2011a), Tidal Muting Study (2011b), Amended Hydrology/Hydraulics Study (Appendix D) and Water Quality Study (Appendix E). From these technical studies, hydrology characteristics within San Elijo Lagoon are discussed relative to the following:

- Water balance and circulation
- Surface hydrology/drainage
- Groundwater hydrology
- Flooding, erosion, and siltation
- Flood control

The discussion of the affected environment below focuses on the hydrologic features and patterns of the lagoon and associated inland surface waters. The dynamics of the adjacent coastline (i.e., the offshore ebb bar at the lagoon mouth) are discussed in Section 3.3 (Oceanography/Coastal Processes), which further describes the effects of storms and waves on the proposed project. Section 3.3 also addresses coastal inlet protection, ocean wave energy effects, and ebb bar formations affecting the lagoon. Off-site materials placement/disposal is proposed for area beaches/nearshore and offshore sites, which are also primarily affected by coastal processes rather than the internal hydrology of the lagoon. Therefore, this section does not address hydrology impacts associated with placement of materials on beaches, in the nearshore, or in the offshore.

Also refer to Section 3.4 (Water and Aquatic Sediment Quality) for a description of the lagoon's water quality characteristics and the potential changes anticipated from the various project alternatives.

3.2.1 AFFECTED ENVIRONMENT

The San Elijo Lagoon is a coastal wetland that occupies approximately 465 acres, dominated by mudflats. The lagoon is traversed by Coast Highway 101, the NTCD Railroad, I-5, and the CDFW weir, which constricts the lagoon and reduces its hydraulic efficiency. Stormwater and urban runoff enters the lagoon through Escondido Creek, Orilla Creek, and adjacent neighborhoods. The watershed upstream from the lagoon has been urbanized over the last several decades, and as urbanization has increased, urban runoff into the lagoon through these creeks has also increased. Historic sedimentation into the lagoon was relatively high due to an undeveloped watershed. Because much of the lagoon's watershed is now highly urbanized, sediment inflow to the lagoon has been low for many years. Therefore, resident sediment within the lagoon primarily represents historical deposition that occurred prior to and during early development in the area (USDA 1993).

The mouth of the lagoon has historically been closed much of the year due to the accumulation of coarse beach sands brought into the inlet from incoming (flood) tidal flows. These beach sand deposits create a flood shoal inside the inlet that reduces the ability of the lagoon to flush during tidal cycles. Because of these cyclical (yet persistent) depositions, outgoing (ebb) tide velocities are also dampened to the point where they are insufficient to scour or transport deposits back to the coast. As a result, tidal exchange with the lagoon and circulation within the lagoon have been constricted and inefficient for decades at the mouth as well as within the tributary channels in each of the three basins. This reduced tidal exchange (i.e., insufficient tidal prism) contributed to the historical accumulation of fine sediments in the east and central basins of the lagoon (USDA 1993). Since the 1990s, the SELC has manually opened the inlet at least annually and maintained an open mouth for much of the time. Sediment accumulation inside portions of the lagoon, particularly the west and central basins, has decreased with the open mouth conditions and the urbanization of the upstream watershed, but historic accumulated sediments remain within the lagoon.

Even under open tidal mouth conditions, muted tidal flow throughout the lagoon occurs due to the inlet configuration (i.e., the presence of a cobble layer underlying Coast Highway 101 that constrains the inlet depth and the long sinuous channel between the railroad bridge and Coast Highway 101 that retards flow due to friction) and channel inefficiencies, particularly in the east basin where flushing is most limited. Manual opening of the tidal inlet conducted by SELC maintains a degree of tidal flushing, but the underlying causes of flood shoal accumulation and inlet closure continue and result in repeated closures.

Water Balance and Circulation

The hydrology within San Elijo Lagoon is largely driven by freshwater supplied from the upstream watersheds and ocean tidal fluctuations from along the coast. However, the hydrologic water balance and the circulation dynamics of the lagoon are dependent on the surrounding landform topography and the lagoon bathymetry, as well as conditions that vary seasonally relative to the following:

- Precipitation (watershed drainage and direct rainfall to the lagoon);
- Tidal prism (seawater/brackish water volume circulating into, within, and out of the lagoon);

- Groundwater level and groundwater/surface flow relationships (e.g., groundwater springs and seepage);
- Urban dry weather runoff;
- Evaporative water loss due to combinations of temperature, humidity, and wind; and
- Aquatic and wetland plant transpiration water loss.

San Elijo Lagoon receives approximately 1 million gallons per day (mgd) of watershed runoff (storm water and urban flows) year-round from Escondido Creek (Gibson 2012). Prior to urbanization, Escondido Creek was an intermittent creek, but it currently behaves as a perennial creek (CWN 2002) due to dry weather urban runoff contributions, causing the water balance to become increasingly dominated by freshwater.

Several human modifications in addition to increased runoff flows affect the water balance and circulation within the lagoon, including Coast Highway 101, the NCTD railroad, the CDFW weir, and I-5. These developments have increased water impounding within the lagoon, thereby increasing water elevations and the resistance to tidal forces. Additionally, the inlet of San Elijo Lagoon is often constricted due to coastal processes (beach sand migration and flood shoal development), which requires manual reopening of the mouth each year to improve tidal flushing and lagoon water quality. A flood shoal modeling study (M&N 2011a) was conducted for the SELRP to evaluate the tidal hydrodynamics and ocean waves/currents that manipulate sand bar formation off the lagoon mouth in the ocean (ebb bar) and within the lagoon (flood shoal). Ebb bars can change incoming ocean wave patterns and consequent changes to the shoreline, while flood shoals can mute or dampen the tides in the lagoon and affect hydrology and water quality.

Shoaling at the inlet, coupled with inefficient drainage patterns of the lagoon, suppresses tidal influence on the lagoon, resulting in a muted tide range (M&N 2012a). A muted tide range results from the hydraulic inefficiencies at the inlet in the lagoon, and water fluctuations within the lagoon do not vary as much as the adjacent ocean during a typical tide cycle. In addition to decreased circulation and associated water quality issues, muted tide ranges lead to artificially narrow intertidal habitat bands and can lead to decreased habitat diversity. Tidal influence decreases with distance inland, reducing circulation from the west basin to the east basin.

The hydraulic inefficiencies within San Elijo Lagoon have led to a consistent degradation of water quality in the lagoon and a change in habitat conditions, described in more detail below under surface hydrology. Active maintenance of the lagoon mouth has improved habitat and water quality by improving tidal exchange and circulation; however, muted tidal exchange and poor circulation continue, which affects habitat distribution and quality and reduces inlet stability. In general, maintaining regular and unmuted tidal exchange improves water circulation throughout water bodies and overall water quality by preventing extreme fluctuations in temperature and salinity. It also leads to habitat conversion, in this case to a more monotypic habitat distribution through the lagoon. Drainage of freshwater fluvial flows from the upstream watershed also continues to be inefficient due to constrictions at the CDFW weir and I-5. Effects on water quality and biological resources are discussed in more detail in Sections 3.4 (Water and Aquatic Sediment Quality) and 3.6 (Biological Resources), respectively.

Surface Hydrology

San Elijo Lagoon is located within the Escondido Creek Hydrologic Area (HA) of the Carlsbad Hydrologic Unit (HU). Figure 3.2-1 shows the study area within the hydrology of the region. The Carlsbad HU encompasses approximately 210 square miles and extends from the headwaters above Lake Wohlford in the east, to the Pacific Ocean to the west, and from the cities of Vista and Oceanside in the north, to Solana Beach and Escondido in the south. There are numerous important surface hydrologic features within the Carlsbad HU, including four ecologically sensitive coastal lagoons, four creeks, and two large water storage reservoirs (Lake Wohlford and Dixon Lake).

The Carlsbad HU is composed of six HAs: Loma Alta, Buena Vista Creek, Agua Hedionda, Encinas, San Marcos, and Escondido Creek (RWQCB 2010). The largest jurisdictional area in the Carlsbad HU is the unincorporated San Diego County areas, with the remaining areas associated with the cities of Carlsbad, San Marcos, and Escondido. Most of the Carlsbad HU is urbanized (48 percent), with residential (29 percent), commercial/industrial (6 percent), freeways and roads (12 percent), agriculture (12 percent), and vacant/undeveloped (32 percent) composing the dominant land uses.

The Escondido Creek HA comprises the largest portion (40 percent) of the Carlsbad HU (CWN 2002). Escondido Creek begins in the headwaters of Lake Wohlford in Bear Valley and ends in San Elijo Lagoon. Elevations within the watershed range from sea level to 2,420 feet on the ridges above Bear Valley. Through the City of Escondido, the creek has been channelized but otherwise remains fairly undeveloped. The land uses of the Escondido Creek HA are also dominated by urban areas (44 percent) with rural residential (15 percent), agriculture (10 percent), and open space (31 percent) occupying the rest (McLaughlin 2010).

The lagoon receives runoff from Escondido Creek, its tributaries, and the smaller La Orilla Creek prior to discharge into the Pacific Ocean. Smaller drainage areas on adjacent land also contribute runoff into the lagoon. Average annual precipitation ranges from 11 to 15 inches.

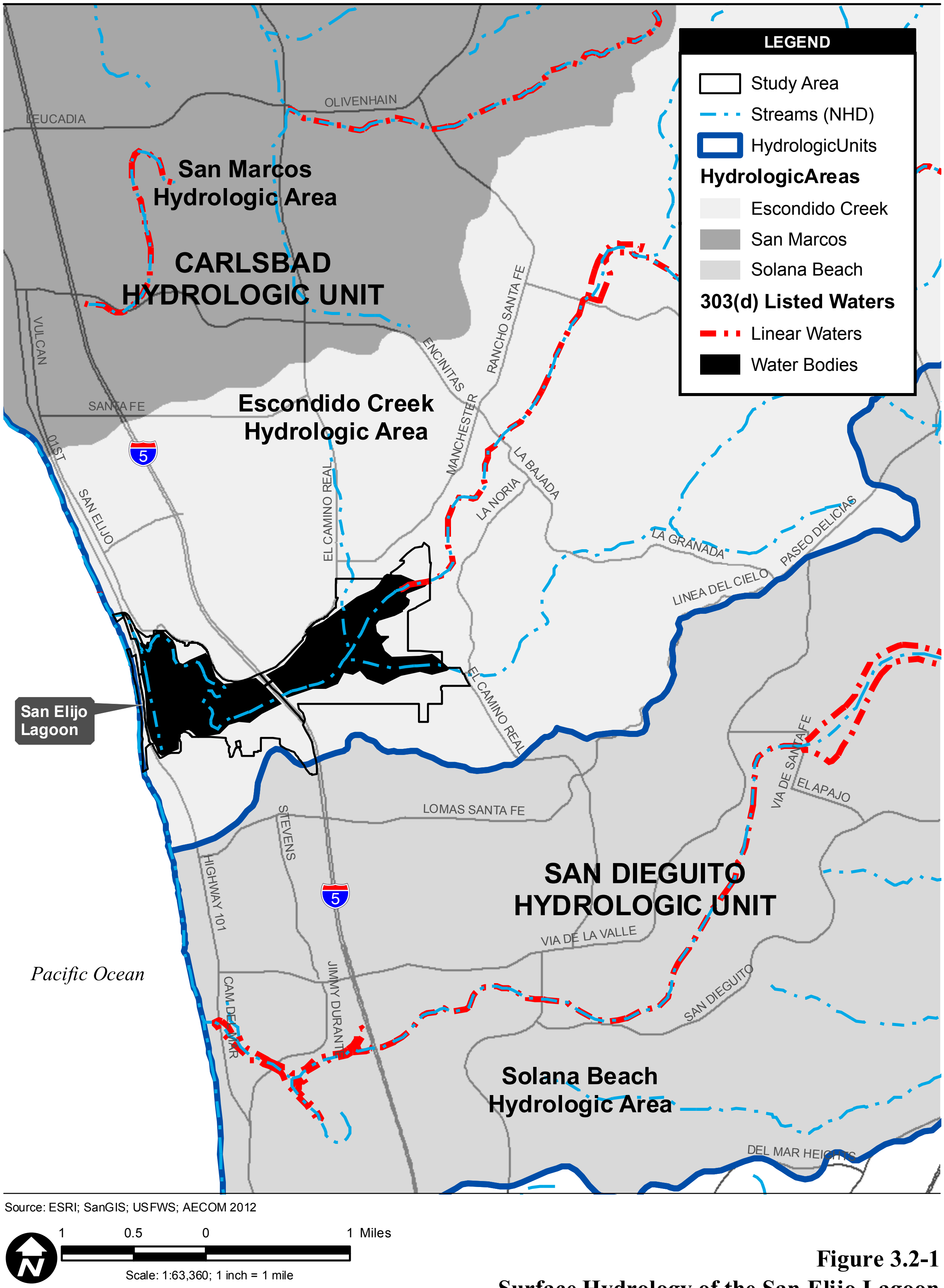

Figure 3.2-1
Surface Hydrology of the San Elijo Lagoon

Surface hydrology within the lagoon plays a large role in determining the habitat distribution that develops and is maintained. As discussed above, the lagoon inlet was historically closed much of the year due to hydraulic constrictions from infrastructure and an inefficient inlet configuration. As runoff to the lagoon from the upstream watershed increased, water within the east basin not only became more brackish and freshwater, but water levels throughout the lagoon increased as they were impounded behind a predominantly closed inlet. This increased freshwater influence and general impoundment led to habitat distributions that included additional freshwater/brackish water marsh habitat in the east basin (e.g., cattails) and habitat types in the lagoon that occurred at higher levels than they would if the lagoon was open. Section 2.1.2 and Section 3.6 (Biological Resources) describe the way a habitat develops based on its inundation frequency, or the amount of time it spends underwater. Once the SELC began maintaining an open inlet to increase water quality and enhance circulation and drainage within the lagoon, historically impounded water levels dropped throughout the lagoon and have led to habitats that are inundated less frequently and for shorter periods of time. Greater exposure in these habitat areas has led to habitat conversion (e.g., functional mudflats that were inundated to the extent that they were unvegetated, but remained shallow enough for foraging, are now exposed frequently enough to become vegetated with low- and mid-marsh plant species). Changes to the hydrology since active management of the lagoon inlet have led to this habitat conversion within the lagoon. Although the open inlet enables the water elevation in the lagoon to be lower in general, fluvial flows continue to be impounded as they enter the lagoon from the upstream watershed. As a result, habitat within the east basin continues to be influenced by freshwater flows that cannot efficiently exit the lagoon.

Groundwater Hydrology

San Elijo Lagoon is underlain by the San Elijo Valley Groundwater Basin. The San Elijo Valley Groundwater Basin underlies two southwest-northeast-trending valleys with Escondido Creek flowing through the upper, northeast valley, and discharging into San Elijo Lagoon. The basin is bounded to the north and south by alluvium with the semipermeable marine deposits of the La Jolla Group. The northeastern boundary is defined by contact with impermeable Cretaceous deposits of the Santiago Peak Volcanics (DWR 2004). The western boundary is the Pacific Ocean.

Natural recharge of the alluvial aquifer is primarily from percolation in Escondido Creek, with smaller amounts contributed by direct precipitation and underflow from the surrounding marine sedimentary units. Infiltration from agricultural and residential uses contributes additional groundwater recharge. Groundwater in this basin is unconfined and characterized by exchange with both the overlying lagoon and adjacent ocean waters (DWR 2004).

In late 2012, USGS and the Olivenhain Municipal Water District (OMWD) installed a research and monitoring well to assess groundwater underlying San Elijo Lagoon for potential potable use. Testing revealed that the groundwater aquifer may be of sufficient quality and quantity to be used as a source of potable water and/or for groundwater recharge (OMWD 2014). The testing results also indicate that this aquifer is at depths substantially lower than the alluvial aquifer directly underlying the lagoon, and that measurable exchange between the lagoon and groundwater is limited to the alluvial aquifer.

Flooding, Erosion, and Siltation

During large storm events, flood flows from the watershed entering the lagoon can force the inlet open by hydraulic force and/or by overtopping with erosive outflow. However, such natural openings happen infrequently, and throughout most of the year (and often during low-rainfall winter seasons), the mouth of the lagoon would remain closed due to poor tidal flushing (i.e., the hydraulically inefficient channel system and the flood shoal formation that results). The sinuous channel extending east from the inlet currently cannot sustain sufficient water velocities to consistently keep the lagoon mouth open to ocean tidal flushing such that it could counteract the constant longshore transport of beach sand. To minimize water quality, circulation, flooding, and habitat issues exacerbated by closed inlet conditions, the lagoon inlet is mechanically opened to maintain hydraulic connectivity between the ocean and the lagoon when natural wet-season flows are otherwise ineffective.

With the maintained open inlet, the general water level has been reduced in the lagoon, but the potential for flooding within adjacent areas remains a concern. Formal mapping of the 100-year floodplain is described below, but flooding currently occurs in some areas under much smaller storm events due to the hydraulic constrictions within the lagoon. While the I-5 and NCTD railroad bridges are proposed for improvements by others (Caltrans and SANDAG, respectively) to enhance hydraulic connectivity and decrease the potential for flooding, the CDFW weir and inlet also contribute to existing flooding concerns along Manchester Avenue in particular. Structures within the lagoon are protected against erosion, and flood flows traveling through the lagoon are typically slowed by the infrastructure as they flow through the lagoon toward the ocean. As a result, erosion along adjacent roadways and trails is relatively low.

Another location in which flooding is a concern is along Coast Highway 101 south of the existing lagoon inlet. Wave runup during storm events currently leads to occasional flooding of the roadway, and riprap that protects the roadbed is at risk of being undermined (personal communication Kathy Weldon, 2014). Sand placement as part of the 2012 RBSP provided some additional protection to the roadway, but as the sand is distributed through the littoral system and the beach narrows, flooding along Coast Highway 101 is expected to continue.

Historically, activities occurring throughout the watershed, such as road development, agriculture, and construction, resulted in erosion and consequent sediment transport that settled out in the lagoon. Escondido Creek and, to a lesser extent, La Orilla Creek, are the historic principal transporters of alluvial sediment. Much of the lagoon sedimentation occurred during earlier decades of heightened construction and agricultural activity, and lagoon sedimentation rates have decreased over time due to urbanized buildout, reduced agriculture, and the initiation of conservation practices (County of San Diego 1996). Sedimentation within San Elijo Lagoon continues, albeit at a reduced level, from upland erosion sources and from littoral transport along the beach area that is brought into the lagoon mouth during tidal cycles.

As mentioned earlier, the effects of the channel constrictions at the CDFW weir, Coast Highway 101, and bridges on I-5 and the NCTD railroad continue to cause flow reductions that induce sediment fallout and entrapment in the lagoon. Within the lagoon itself, circuitous channel configurations also reduce flow rates and promote the settling of sediment in the lagoon from both upland and coastal sources. As a result of decades of poor circulation, consistent sediment loading (particularly prior to urbanization of the watershed), and insufficient inlet maintenance, the east and central basins of the lagoon have built up significant deposits of primarily fine sediments. In general, the lagoon consists of a thin layer of fine-grained material (~29 percent fines) that overlays a thick, relatively homogenous layer of sandy materials (~10 percent fines). The upper layer of material represents a small fraction (approximately 9 percent) (M&N 2013).

According to the Ebb Bar and Flood Shoal Study (M&N 2011a), dredge records and modeling indicate that San Elijo Lagoon has a flood shoal volume of 63,300 cy at equilibrium. To maintain the inlet open to tidal flushing, the SELC manually opens the inlet at least annually and removes approximately 30,000 cy of sediment. Refer to Section 3.3 (Oceanography/Coastal Processes) for additional details on coastal processes and morphology, including information on ebb bar formation in the nearshore area off the inlet. The flood shoal is composed of material entrained in the inlet and is primarily sand. As sand, it has a relatively large grain size and settles out relatively quickly when compared to upland sediment sources that can be much finer-grained silts and clays. Therefore, the flood shoal remains near the inlet location and does not generally result in sedimentation in adjacent habitat areas, making removal through inlet maintenance an effective means of sediment control. When this material is removed as part of inlet maintenance, it is placed on the south side of the inlet in a process known as bypassing. This occurs at a number of lagoons and coastal inlets along the San Diego coastline, and enables sand travelling alongshore in a littoral current to continue to provide material for the littoral sand cycle.

Flood Control

The need for controlling floodwaters is based on geographic flood zone areas that FEMA defines according to varying levels of flood risk. These zones are depicted on FIRM or Flood Hazard Boundary Maps. Each zone reflects the severity or type of flooding in the area. A large percentage of the lagoon and adjacent areas, particularly to the north of the lagoon, are located within the FEMA 100-year or 500-year flood zone. San Elijo Lagoon is a part of the Escondido Creek floodplain. Although located farther upstream in the watershed, Lake Wohlford and Dixon Lake offer some flood control for Escondido Creek and San Elijo Lagoon.

Within the lagoon footprint, the CDFW weir, Coast Highway 101, NCTD railroad, and I-5 have contributed to restricting the movement and release of flood flows through the lagoon to the Pacific Ocean. As these structures were constructed, no formal flood control measures were implemented within the lagoon to compensate for the exacerbation of flood conditions. Low-lying areas along the floodplains of Escondido Creek and its tributaries can experience flooding during severe rain events that are smaller than the 100-year event as well. The current 100-year flood elevations around the east basin and along Manchester Avenue exceed the road elevation by 2 to 4 feet, depending on location and analysis approach, and are often flooded during moderate storms. Manchester Avenue lies at an elevation of between 9.3 and 10.4 feet NGVD, and stormflood waters have reached between 12.3 and 13.3 feet NGVD in the lagoon.

3.2.2 CEQA THRESHOLDS OF SIGNIFICANCE

A significant impact related to hydrology would occur if implementation of the SELRP results in substantial negative temporary (construction-related) or permanent (post-construction) effects on:

A. Lagoon circulation, surface drainage patterns or amount of surface runoff;
B. Groundwater quality and/or recharge;
C. The potential for flooding, erosion, or siltation; or
D. The potential for exposure of people or property to water-related hazards such as flooding

The CEQA thresholds of significance for hydrology were derived from a combination of thresholds listed in Appendix G of the CEQA Guidelines and thresholds used in the EIR/EIS for the Bolsa Chica Lowlands Restoration Project (SCH #2000071068) and the 2012 RBSP EA/EIR (SCH #2020051063).

3.2.3 Environmental Consequences

A variety of numeric models were used to analyze lagoon hydraulics, tidal behavior, tidal prism, flood shoal formation, inlet stability, 100-year flood elevations, and other water depth/circulation dynamics (Appendix D) (M&N 2011a, 2011b, 2012a). Table 3.2-1 presents predicted tidal ranges at several locations within the lagoon for each alternative, and the ocean tidal range for comparison. Each location represents conditions within the lagoon moving eastward from the ocean.

Table 3.2-1
Predicted Tidal Ranges for Restoration Alternatives

Alternative	Tidal Range (feet)					
	Ocean	Highway 101	West Basin	Central Basin	I-5	East Basin
Existing	7.97	4.56	3.99	3.85	3.78	3.76
1A	7.97	7.11	5.56	5.26	5.21	5.15
1B	7.97	6.58	5.44	5.42	5.42	5.43
2A	7.97	7.97	7.93	7.92	7.87	7.88

Source: M&N 2012a

Table 3.2-2 illustrates the maximum 100-year flood elevation within the lagoon at various locations for each alternative.

Table 3.2-2
Maximum 100-Year Flood Elevation in the Wetlands (feet, NGVD)
Based on +5.4-Foot NGVD (Recorded Highest) Downstream Tidal Elevation

Virtual Gage Locations	Manchester Avenue Elevation	Existing	Alt 1A	Alt 1B	Alt 2A
HW101	N/A	5.3	5.3	5.3	5.3
RR	N/A	8.5	7.9	8.1	6.3
CB1	29.0	8.9	8.4	8.7	6.5
CB2	9.8	9.0	8.5	8.7	6.7
I-5	12.7	9.4	8.9	8.8	7.3
EB1	12.9	9.8	9.8	8.8	7.5
EB2	9.3	**12.3**	**11.7**	9.0	8.1
EB3	10.3	**12.4**	**11.7**	9.0	8.3
EB4	10.4	**12.3**	**11.8**	9.0	8.4

Note: Values in **bold** indicate elevations above the roadway and represent potential flooding.

For each alternative, potential substantial adverse, significant, or beneficial temporary and permanent, direct and indirect impacts are identified below.

Alternative 2A–Proposed Project

Temporary

Temporary impacts to hydrology could occur during construction activities, including diking and inundating areas for dredging, grading along the perimeter and access roads, equipment staging, and on-site materials disposal and placement. Construction would be phased as described in Chapter 2, and dry disturbed areas would be generally limited to staging areas, access road improvements, and areas disturbed during bridge construction. Wet disturbed areas would include portions of the lagoon basins dredged to lower elevations or built up as transitional areas. During the construction process, there would be temporary but dynamic changes to the lagoon's water balance (inflow/outflow; depth), circulation, and surface hydrology. During periods of inundation within certain areas of the lagoon, water levels within diked off areas would increase relative to existing conditions, altering flow regimes. Inundated areas could be subject to slower velocities as they are separated from main channel and inlet flows, so increased erosion and/or siltation would not be anticipated. In addition, as noted above, sediment entering the lagoon has decreased as the upstream watershed has been developed, so siltation due to incoming runoff would not increase substantially. Some circulation would continue to occur due to dredge and support equipment movement and wind wave-driven circulation. Figure 2-16 shows those areas that, once dredged, would be exposed as open water channels, tidal mudflats, or salt marsh once re-established by marsh vegetation. Dredged areas would be opened to tidal action, and would begin to revegetate immediately through natural plant recruitment. Additional planting of specific habitat would also occur, if necessary, to facililtate recovery. Periodic maintenance activities would cause temporary dredging of the channels. Since tidal flows in areas subject to turbidity (eastern portions of the project) would remain relatively slow through newly dredged areas, and since areas identified as sensitive to erosion (channel slopes under infrastructure) would be structurally protected as described in Chapter 2, turbidity during construction and maintenance activities would be within the parameters of what would be expected for a naturally functioning lagoon condition. See Section 3.4, Water and Aquatic Sediment Quality for a discussion of water quality impacts related to turbidity.

Erosion and sediment control would also be addressed in the project-specific permit(s) required under the National Pollutant Discharge Elimination System (NPDES) Permit to the County for the Municipal Separate Storm Sewer Systems (MS4s) implemented by the County's Watershed Protection Ordinance (WPO) and to the Regional Water Quality Control Board (RWQCB) for the California Construction General Permit implented by a project-specific Storm Water Pollution Prevention Plan (SWPPP) (PDF-21). For portions of the project that increase impervious surfaces, the County's Permit requires a Stormwater Management Plan (SWMP), a Hydromodification Management Plan (HMP), and low-impact development (LID) best management practices (BMPs) to eliminate pollutants from leaving the project/construction site and to require project operations to eliminate any added downstream sedimentation or runoff. This process would be required for the bridge during preparation of construction plans unless superseded by a Caltrans or Corps permit, to be decided at some time in the future.

The state-required SWPPP mandates implementation of sediment- and erosion-control BMPs in construction and post-construction phases to minimize impacts on surface drainage patterns and the amount of surface runoff. The SWPPP and SWMP, HMP, and LID plans are to be developed and implemented by the contractor in compliance with existing regulations. The SWPPP and SWMP, HMP, and LID plans would conform with a variety of federal, state, and local regulatory requirements (e.g., Section 111.5 and Appendix F of the Construction General Permit [Order 2010-0014-DWQ]) and require implementation of construction BMPs to stabilize soils during land-based construction and staging/access to minimize erosion/siltation. Section 3.4 (Water and Aquatic Sediment Quality) identifies specific BMPs that could be implemented as part of the SWPPP and SWMP, HMP, and LID plans.

Dikes would incorporate a mechanism to control water elevations and allow the release of water if runoff into the diked areas raises water levels above 5 or 6 feet National Geodetic Vertical Datum (NGVD) in the east or central and west basins, respectively. Proposed elevations would remain below the 100-year storm water elevation. Flooding of adjacent infrastructure and/or roadways would not occur and the potential for exposure of people or property to hazards such as flooding would not be increased over existing conditions. Water level would return to pre-construction elevations (i.e., approximate mean sea level) once each area is reopened to tidal flow. Upon the completion of construction, circulation and surface drainage patterns within the lagoon would be improved. **Temporary impacts would not be substantially adverse and impacts would be less than significant to lagoon circulation and drainage patterns, flooding, erosion or siltation, or increased exposure to water-related hazards (Criteria A, C, and D).**

The lagoon is underlain by an unconfined alluvial groundwater basin that is characterized by exchange with both the overlying lagoon and adjacent ocean waters. **Impacts from construction activities would be less than significant for altering existing conditions related to the exchange of lagoon and groundwater that could result in substantial impacts to groundwater quality and/or recharge characteristics (Criterion B). No substantial adverse impacts would occur.**

<u>Permanent</u>

Alternative 2A would increase the hydraulic efficiency of San Elijo Lagoon by creating a new, more stable inlet, increasing and extending the channel network within the lagoon basins, and improving infrastructure to minimize constrictions at crossings. Drainage patterns and circulation within the lagoon would be altered, but would benefit the lagoon overall with respect to biological resources and water quality, in particular. Circulation would increase with the new inlet and improved channel network. Hydrology throughout the lagoon would be greatly improved through the creation of a new and enlarged inlet mouth and enhanced channel flow regimes that would allow freshwater to flow out of the lagoon and promote improved tidal exchange deeper to the inland areas of the lagoon.

Removal of the CDFW dike and improvements at I-5 (proposed by Caltrans), the railroad (proposed by SANDAG), and Coast Highway 101, as well as straightening and enlarging the main channel, would enable the lagoon to drain incoming freshwater more efficiently. Drainage would be more efficient both during dry weather flows that currently support freshwater habitat (e.g., cattails) east of I-5, as well as during storm events, leading to less potential in general for flooding hazards, which are discussed in more detail below. These same improvements to the channel network would increase tidal influence in the east basin of the lagoon.

Tidal influence would be increased throughout the lagoon by constructing a new, larger, and more stable inlet south of the existing inlet. The new inlet would provide less muted flow directly into lagoon channels. The larger cross-sectional profile area of the dredged channels would offer less resistance to tidal fluctuation and allow a greater volume of tidal exchange, giving the lagoon a greater opportunity to flush more readily than existing conditions. This inlet would provide additional circulation to the east basin, as well as throughout the central and west basins through the extension of the existing channel network. This additional circulation would promote lower residence times and higher water quality conditions throughout the lagoon compared to existing conditions (discussed in Section 3.4 [Water and Aquatic Sediment Quality]).

As shown in Table 3.2-1, Alternative 2A would result in a substantially larger tide range than currently exists in the lagoon, providing a range very close to the open ocean, essentially eliminating the muting effects of the current lagoon inlet (e.g., since the tide range would be very close to open ocean tide range).

The anticipated increase in tide range under Alternative 2A would shift the inlet from a flood-dominated system to an ebb-dominated system, leading to a more stable inlet condition. Alternative 2A would create a larger inlet at a new location. As discussed in Section 3.3 [Coastal Processes], this new ebb bar is predicted to have a volume of approximately 345,000 cy at equilibrium. This is a substantial increase from the existing ebb bar of 3,600 cy at the current inlet. The ebb bar would be larger than the volume of the flood bar (266,000 cy) and the new inlet would result in a more tidally stable ebb-dominated system. This shift to an ebb-dominated system would reduce the entrainment of sand moving along the coast into the inlet, and slow the development of a flood shoal, leading to an inlet that remains open for longer periods of time and maintaining a less muted tide range for longer periods of time. Therefore, although Alternative 2A would involve the largest amount of initial dredging and a greater amount of initial sediment removal, it would require maintenance dredging every 3 to 4 years compared to the annual maintenance currently required. By changing the lagoon to an ebb flow-dominated hydrologic system, the necessity for repeated inlet and/or channel maintenance would be less frequent than the current inlet condition, although volumes removed during each maintenance event are anticipated to be greater.

Alternative 2A would result in a net increase in impervious area of 0.53 acre. Concrete would be removed from the CDFW weir in the east basin of the lagoon, a new bridge would be constructed over the new inlet along the existing Coast Highway 101 road segment already traversing the lagoon, and a permanent launch ramp would be built for a dredge in the Central Basin. The weir would be removed from an inundated area, and there would be no anticipated change to infiltration and no substantial change in surface runoff amounts in the lagoon; the launch would have a very small footprint. The bridge would require separate construction plans that would trigger a County Priority Development Project SWMP with HMP and LID requirements. The result would be that there would not be any substantial changes in the amount of surface runoff into the lagoon.

Hydrologic improvements associated with Alternative 2A would improve existing constrictions within the lagoon restricting water flow and circulation. This alternative would also improve the ability of the lagoon to drain freshwater currently impounded in the east basin and improve tidal influence throughout the basins. A more stable tidal inlet would also result in longer periods of unmuted tidal exchange between the ocean and lagoon. Alternative 2A, though changing the existing drainage patterns, would result in a beneficial impact on circulation and surface drainage patterns. **The project's impact on surface runoff and drainage patterns would be less than significant. No substantial adverse or significant impacts would occur (Criterion A).**

Alternative 2A would enlarge the tidal channel network throughout the lagoon and enhance the ability of the lagoon to drain incoming freshwater flows currently impounded in the east basin, as described above. While the salinity of the lagoon would generally increase across the lagoon basins, water would continue to be present in all of the basins and would not substantially change. The lagoon is currently underlain by an unconfined alluvial groundwater basin that is characterized by exchange with both the overlying lagoon and adjacent ocean waters. Measurable exchange between the lagoon and groundwater is likely limited to the alluvial aquifer (discussed above under Groundwater Hydrology), and increased tidal circulation and shift in salinity within the lagoon would not represent a substantial change to conditions that influence **groundwater quality and/or recharge characteristics; impacts would be less than significant (Criterion B) and would not be substantially adverse.**

Alternative 2A would enhance the ability of the lagoon to drain fluvial flows to the ocean through improvements to the main channel and infrastructure constriction points, as discussed above. Improved drainage would generally reduce the potential for flooding to occur within the lagoon and along adjacent infrastructure during dry weather flows and small storm events. Flow volumes through the lagoon may increase, creating the potential for erosion in specific locations. As discussed in Chapter 2, infrastructure protection has been incorporated into the project design and these areas would not be susceptible to erosion under higher flow velocities.

Siltation within the lagoon could occur from inputs from upstream fluvial flows, erosion within the lagoon, or sediment entering from the coast. Sediment entering the lagoon has decreased as the upstream watershed has been developed, so siltation due to incoming runoff would not increase substantially under any of the build alternatives. Erosion along the lagoon channels would not be substantial due to protection designed for protection in areas predicted to be susceptible to scour. Directly after construction, there may be exposed soils that could be susceptible to erosion within the lagoon. These areas are anticipated to become vegetated as soils stabilize and natural recruitment or restoration planting occurs, and erosion would be short term and not substantial. The potential for erosion would also be expected to decrease with increased habitat value and soil stability (primarily vegetation) and improved erosion control.

Entrainment of sand from the littoral zone entering the lagoon inlet is discussed above in the context of the flood shoal that would develop between maintenance cycles. Alternative 2A would shift the lagoon from a flood-dominated system to an ebb-dominated system and would result in a relatively slow accumulation of the flood shoal. Sand would continue to enter the lagoon; however, sand is relatively large in grain size and typically settles out of the water column relatively quickly. The creation of a sedimentation basin inside of the inlet and the grain size characteristics of entering sand would limit siltation to within the inlet area, minimizing impacts to surrounding habitat areas. Shoals would be monitored by SELC on a semi-annual basis and removed during regular maintenance or as-needed (PDF-31). **Therefore, impacts to flooding, erosion, and/or siltation would be less than significant (Criterion C). No substantial adverse impacts would occur.**

Flood elevations during the 100-year storm event are currently mapped as extending over adjacent Manchester Avenue in a number of locations, as identified in Table 3.2-2. Alternative 2A would reduce flood elevations compared to existing conditions with improved lagoon hydrology proposed under this alternative. Flood elevations would be reduced to levels below Manchester Avenue along its length due to expanded channel cross-sections under each of the lagoon bridges and improvements to the lagoon channel network and proposed new inlet. This reduction would decrease the potential for people and property to be exposed to flooding and other such water-related hazards. Channel and infrastructure improvements would be reviewed by Caltrans, the City of Solana Beach, and the City of Encinitas, as appropriate, prior to approval of project grading plans (PDF-40).

Coordination with the City of Encinitas and FEMA representatives has indicated that the LOMR would be provided after construction is completed and would be filed to formally modify the FIRM, or Flood Boundary and Floodway Map (FBFM), or both (PDF-39). This alternative would not require a CLOMR, which is needed if a proposed project causes an increase in flood elevation of greater than 1.00 foot and is within a flood area designated as Zone A. **No substantial adverse direct or indirect effects to flooding or other hazards have been identified associated with implementation of Alternative 2A. Impacts would be less than significant (Criterion D). Direct and indirect effects to flooding or other hazards have also been addressed in Section 3.5 (Geology/Soils).**

Alternative 1B

<u>Temporary</u>

Temporary impacts as a result of the implementation of Alternative 1B would be similar to those discussed for Alternative 2A. Alternative 1B would require less dredging, grading, and ground disturbance for initial implementation than Alternative 2A, although the general construction approach, including phasing and diking off areas for inundation, would be similar. Construction would be phased, with dry disturbed areas generally limited to staging areas and access road improvements, and wet disturbed areas limited to portions of the lagoon dredged to lower elevations or built up as transitional areas.

Temporary impacts to hydrology could occur during construction activities; during periods of inundation within the lagoon, water levels within diked off areas would increase relative to existing conditions, altering flow regimes. Increased erosion and/or siltation would not be anticipated, and some circulation would continue to occur due to dredge and support equipment movement and wind wave-driven circulation. Figure 2-17 shows those areas that, once dredged, would be exposed as open water channels, tidal mudflats, or salt marsh once re-established by marsh vegetation. Dredged areas would be opened to tidal action, and would begin to naturally revegetate through plant recruitment. Additional planting of specific habitat would also occur, as needed, to facililtate recovery. Periodic maintenance activities would cause temporary dredging of the channels. Since tidal flows in areas subject to turbidity (eastern portions of the project) would remain relatively slow through newly dredged areas, and since areas identified as sensitive to erosion (channel slopes under infrastructure) would be structurally protected as described in Chapter 2, turbidity during construction and maintenance activities would be within the parameters of what would be expected for a naturally functioning lagoon; impacts would be less than significant.

Erosion and sediment control would also be addressed in the project SWPPP and SWMP, HMP, and LID plans, to be developed and implemented by the contractor in compliance with existing regulations (PDF-21). These plans would require implementation of construction BMPs to stabilize soils during land-based construction and staging/access and minimize erosion/siltation. Section 3.4 (Water and Aquatic Sediment Quality) identifies specific BMPs that could be implemented as part of the SWPPP and SWMP, HMP, and LID plans.

Dikes would incorporate a mechanism to control water elevations and allow the release of water to avoid flooding of adjacent infrastructure and/or roadways. The potential for exposure of people or property to hazards such as flooding would not be increased over existing conditions. **Temporary impacts would not be substantially adverse and impacts would be less than significant related to lagoon circulation and drainage patterns, flooding, erosion or siltation, or increased exposure to water-related hazards (Criteria A, C, and D).**

The lagoon is underlain by an unconfined alluvial groundwater basin that is characterized by exchange with both the overlying lagoon and adjacent ocean waters. Construction activities would not substantially alter existing conditions related to the exchange of lagoon and groundwater that could result in substantial impacts to groundwater quality and/or recharge characteristics. **Impacts would be less than significant (Criterion B). No substantial adverse impacts would occur.**

<u>Permanent</u>

Alternative 1B would increase the hydraulic efficiency of San Elijo Lagoon to a lesser extent than Alternative 2A. The existing inlet would be retained under Alternative 1B, and improved. There is a rock sill located under the existing inlet, which constrains the degree to which tidal exchange between the lagoon and ocean can be increased. The hydraulic conductivity within the main channel would increase because it would be straightened and enlarged, and the channel network within the lagoon basins would be enlarged and extended to improve circulation into the secondary channel network. Infrastructure would be improved to minimize constrictions at crossings, including removal of the CDFW dike and improvements at I-5 (proposed by Caltrans) and the railroad (proposed by SANDAG). These improvements within the channel network and at key infrastructure crossings would enable the lagoon to drain incoming freshwater more efficiently, both during dry weather flows and storm events. These same improvements to the channel network would increase tidal influence in the east basin of the lagoon.

Drainage patterns and circulation within the lagoon would be altered with implementation of Alternative 1B, but would benefit the lagoon overall with respect to biological resources and water quality, in particular. Circulation would increase with the new inlet and improved channel network. Hydrology throughout the lagoon would be improved through the enhancement of the existing lagoon inlet and enhanced channel flow regimes that would allow freshwater to flow out of the lagoon and promote improved tidal exchange deeper to the inland areas of the lagoon.

Tidal influence would be increased throughout the lagoon by improving the existing inlet, although to a lesser extent than Alternative 2A. The improved inlet configuration would provide less muted flow directly into lagoon channels compared to existing conditions although, as shown in Table 3.2-1, tides would become more muted extending east into the lagoon. The increased tide range would give the lagoon a greater opportunity to flush more readily than existing conditions. The improved inlet would provide additional circulation to the east basin, as well as throughout the central and west basins through the extension of the existing channel network. This additional circulation would promote lower residence times and higher water quality conditions throughout the lagoon compared to existing conditions (discussed in Section 3.4 [Water and Aquatic Sediment Quality]). Upstream sediment that currently has the opportunity to settle out when water backs up behind the CDFW dike would be able to flush from the lagoon and contribute to the littoral zone. Additional tidal exchange and flushing would result in larger and heavier particle size (sand) in the western portions of the channel system where tidal flows may be faster. In the eastern portions of the project where most of the smaller, lighter sediment particles are located, tidal flushing would be slower and channels would also be resistant to tidal erosion. Structures and strategic infrastructure threatened by erosion during stormflow events would be protected throughout the lagoon by shore protection measures, thus managing erosion during higher-velocity storm flows and preventing damage (PDF-31).

As discussed in Section 3.3 [Coastal Processes], under Alternative 1B, the flood bar would remain substantially larger than the volume of the ebb bar. The inlet would remain flood dominated, as it is under existing conditions, although in the dredged condition, tidal exchange between the lagoon and ocean would be increased over existing conditions, as discussed above. Sand would continue to be entrained in the inlet in a developing flood shoal that would require removal each year to maintain an open inlet condition with the predicted tide ranges. The necessity for repeated inlet and/or channel maintenance would continue similar to the current inlet condition, although volumes removed during each maintenance event are anticipated to be slightly greater, as noted in Chapter 2.

Alternative 1B would result in a net decrease in impervious area of 0.23 acre due to removal of the CDFW weir. A permanent launch ramp would be built for a dredge in the Central Basin as part of Alternative 1B, which would slightly increase impervious areas within the lagoon. The CDFW weir would be removed from the east basin of the lagoon and replaced with vegetated transitional habitat. However, because the weir is being removed from an inundated area, there would be no anticipated change to infiltration and no substantial change in surface runoff amounts in the lagoon.

Hydrologic improvements associated with Alternative 1B would improve existing constrictions within the lagoon restricting water flow and circulation. This alternative would also improve the ability of the lagoon to drain freshwater currently impounded in the east basin and improve tidal influence throughout the basins. Though changing existing drainage patterns, this alternative would result in a beneficial impact on circulation and surface drainage patterns. The **change to the amount of surface runoff would result in less than significant impacts. No substantial adverse or significant impacts would occur (Criterion A).**

Alternative 1B would enlarge the tidal channel network throughout the lagoon and enhance the ability of the lagoon to drain incoming freshwater flows currently impounded in the east basin, as described above. While the salinity of the lagoon would generally increase across the lagoon basins, water would continue to be present in all of the basins and would not substantially change. The lagoon is currently underlain by an unconfined alluvial groundwater basin that is characterized by exchange with both the overlying lagoon and adjacent ocean waters. The increased tidal circulation and shift in salinity within the lagoon **would not represent a substantial change to conditions that influence groundwater quality and/or recharge characteristics. Impacts would be less than significant (Criterion B) and would not be substantially adverse.**

Alternative 1B would enhance the ability of the lagoon to drain fluvial flows to the ocean through improvements to the main channel and infrastructure constriction points, as discussed above. Improved drainage would generally reduce the potential for flooding to occur within the lagoon and along adjacent infrastructure during dry weather flows and small storm events. Flow volumes through the lagoon may increase, creating the potential for erosion in specific locations. As discussed in Chapter 2, infrastructure protection has been incorporated into the project design and these areas would not be susceptible to erosion under higher flow velocities.

Siltation within the lagoon could occur from inputs from upstream fluvial flows, erosion within the lagoon, or sediment entering from the coast. Sediment entering the lagoon has decreased as the upstream watershed has been developed, so siltation due to incoming runoff would not increase substantially under any of the build alternatives. Erosion along the lagoon channels would not be substantial due to protection designed for areas predicted to be susceptible to scour. Directly after construction, there may be exposed soils that could be susceptible to erosion within the lagoon. These areas are anticipated to become vegetated as soils stabilize and natural recruitment or restoration planting occurs, and erosion would be short term and not substantial. Entrainment of sand from the littoral zone entering the lagoon inlet is discussed above in the context of the flood shoal that would develop between maintenance cycles. Alternative 1B would increase the stability of the lagoon inlet but the lagoon would continue to be a flood-dominated system. Sand would continue to enter the lagoon and accumulate into a flood shoal. Sand is relatively large in grain size, however, and typically settles out of the water column relatively quickly. The inlet channel between Coast Highway 101 and the railroad bridge would be protected with riprap along both sides, and would provide a discrete location for the flood shoal to develop without substantially affecting adjacent habitat areas. Shoals would be monitored by SELC on a semi-annual basis and removed during regular maintenance or as-needed (PDF-31). **Impacts to flooding, erosion, and/or siltation would be less than significant (Criterion C). No substantial adverse impacts would occur.**

Alternative 1B would provide flood reduction potential compared to existing conditions. The lagoon channel network and infrastructure improvements would enhance hydraulic connectivity between the lagoon and ocean, and allow fluvial flows to drain from the lagoon more efficiently. As shown in Table 3.2-2, Manchester Avenue would not be flooded during the 100-year flood. No residences or additional structures would be at risk for flooding under the 100-year storm event. Channel and infrastructure improvements would be reviewed by Caltrans, the City of Solana Beach, and the City of Encinitas, as appropriate, prior to approval of project grading plans (PDF-40).

Coordination with the County, City of Encinitas, and FEMA representatives has indicated that the LOMR would be provided after construction is completed and would be filed to formally modify the FIRM, or Flood Boundary and Floodway Map (FBFM), or both (PDF-39). This alternative would not require a CLOMR, which is needed if a proposed project causes an increase in flood elevation of greater than 1.00 foot and is within a flood area designated as Zone A. **No substantial adverse direct or indirect effects to flooding or other hazards have been identified associated with implementation of Alternative 1B. Impacts would be less than significant (Criterion D).**

Alternative 1A

Temporary

Temporary impacts as a result of the implementation of Alternative 1A would be similar to those discussed for Alternative 1B, but Alternative 1A would require less dredging, grading, and ground disturbance for initial implementation than Alternative 1B, and impacts would be less. Construction would be phased, with dry disturbed areas generally limited to staging areas and access road improvements, and wet disturbed areas limited to portions of the lagoon dredged to lower elevations or built up as transitional areas. The construction approach for Alternative 1A is also different than for Alternative 2A and Alternative 1B and would not include temporary inundation of diked off areas. Instead the dredge would remain within the main channel network, limiting bottom sediment disturbance within the lagoon. Increased erosion and/or siltation would not be anticipated because velocities within the channels/lagoon would not substantially change from existing conditions during construction.

Erosion and sediment control would also be addressed in the project SWPPP and SWMP, HMP, and LID plans to be developed and implemented by the contractor in compliance with existing regulations (PDF-21). These plans would require the implementation of construction BMPs to stabilize soils during land-based construction and staging/access and minimize erosion/siltation. Section 3.4 (Water and Aquatic Sediment Quality) identifies specific BMPs that could be implemented as part of the SWPPP and SWMP, HMP, and LID plans.

The construction approach proposed for Alternative 1A would not alter the current circulation within the lagoon, and the potential for exposure of people or property to hazards such as flooding would not be increased over existing conditions. **Temporary impacts would not be substantially adverse and less than significant impacts would occur to lagoon circulation and drainage patterns, flooding, erosion or siltation, or increased exposure to water-related hazards (Criteria A, C, and D).**

The lagoon is underlain by an unconfined alluvial groundwater basin that is characterized by exchange with both the overlying lagoon and adjacent ocean waters. Construction activities would not substantially alter existing conditions related to the exchange of lagoon and groundwater that could result in substantial impacts to groundwater quality and/or recharge characteristics **No impact to groundwater exchange would occur (Criterion B).**

<u>Permanent</u>

Alternative 1A would increase the hydraulic efficiency of San Elijo Lagoon to a lesser extent than Alternative 2A or Alternative 1B. The existing inlet would be retained under Alternative 1A, and improved. There is a rock sill located under the existing inlet, which constrains the degree to which tidal exchange between the lagoon and ocean can be increased. The hydraulic conductivity within the main channel would increase because it would be straightened and enlarged, although the secondary channel network within the lagoon basins would not be modified under Alternative 1A, limiting hydrologic improvements to the main channel and adjacent areas. Infrastructure would be improved to reduce constrictions at crossings, including the installation of two culverts through the existing CDFW dike and improvements at I-5 (proposed by Caltrans) and the NCTD railroad (proposed by SANDAG). Improvements within the main channel and at key infrastructure crossings would enable the lagoon to drain incoming freshwater more efficiently compared to existing conditions, both during dry weather flows and storm events. These same improvements would increase tidal influence in the east basin of the lagoon.

Drainage patterns and circulation within the lagoon would be altered with implementation of Alternative 1A, but would benefit the lagoon overall with respect to biological resources and water quality, in particular. Circulation would increase with the new inlet and improved main channel, although benefits would be smaller than those identified under Alternative 2A or Alternative 1B.

Tidal influence would be increased compared to existing conditions by improving the existing inlet, although to a lesser extent than Alternative 1B in the central and east basins. The improved inlet configuration would provide less muted flow although, as shown in Table 3.2-1, tides would become more muted extending east into the lagoon. The improved inlet would provide additional circulation to the east basin, as well as throughout the central and west basins, although these improvements would be primarily limited to the main channel.

As discussed in Section 3.3 [Coastal Processes], under Alternative 1A, the flood bar would remain substantially larger than the volume of the ebb bar, similar to existing conditions. The inlet would remain flood dominated, although in the dredged condition, tidal exchange between the lagoon and ocean would be increased over existing conditions, as discussed above. Sand would continue to be entrained in the inlet in a developing flood shoal that would require removal each year to maintain an open inlet condition with the predicted tide ranges. The necessity for repeated inlet and/or channel maintenance would continue similar to the current inlet condition, although volumes removed during each maintenance event are anticipated to be slightly greater, as noted in Chapter 2. As noted above, the CDFW weir would remain in place, with the addition of two culverts to promote fluvial water flow from the watershed to the ocean, resulting in no measurable decrease in impervious surfaces. No structures that would increase impervious area within or adjacent to the lagoon are proposed as part of Alternative 1A. A temporary dredge launch ramp would be installed just for construction and removed after construction. Alternative 1A would not result in a change in impervious area, so it would not substantially affect surface runoff into the lagoon.

Hydrologic improvements associated with Alternative 1A would improve existing constrictions within the lagoon restricting water flow and circulation. This alternative would also improve the ability of the lagoon to drain freshwater currently impounded in the east basin and improve tidal influence throughout the basins. Though changing existing drainage patterns, this alternative would result in a beneficial impact on circulation and surface drainage patterns. **No impact in surface runoff would occur. No substantial adverse or significant impacts would occur (Criterion A).**

Alternative 1A would enlarge the main channel in the lagoon and enhance the ability of the lagoon to drain incoming freshwater flows currently impounded in the east basin, as described above. While salinity of the lagoon would generally increase across the lagoon basins, water would continue to be present in all of the basins and would not substantially change.

The lagoon is currently underlain by an unconfined alluvial groundwater basin that is characterized by exchange with both the overlying lagoon and adjacent ocean waters. Measurable exchange between the lagoon and groundwater is likely limited to the alluvial aquifer (discussed above under Groundwater Hydrology)**.** The increased tidal circulation and shift in salinity within the lagoon **would not represent a substantial change to conditions that influence groundwater quality and/or recharge characteristics, and impacts would be less than significant (Criterion B) and impacts would not be substantially adverse.**

Alternative 1A would enhance the ability of the lagoon to drain fluvial flows to the ocean through improvements to the main channel and infrastructure constriction points, as discussed above. Improved drainage would generally reduce the potential for flooding to occur within the lagoon and along adjacent infrastructure during dry weather flows and small storm events. Flow velocities through the lagoon may increase, creating the potential for erosion in specific locations. As discussed in Chapter 2, infrastructure protection has been incorporated into the project design and these areas would not be susceptible to erosion under higher flow velocities.

Siltation within the lagoon could occur from inputs from upstream fluvial flows, erosion within the lagoon, or sediment entering from the coast. Sediment entering the lagoon has decreased as the upstream watershed has been developed, so siltation due to incoming runoff would not increase substantially under any of the build alternatives. Erosion along the lagoon channels would not be substantial due to protection designed for areas predicted to be susceptible to scour. Directly after construction, there may be exposed soils that could be susceptible to erosion within the lagoon. These areas are anticipated to become vegetated as soils stabilize and natural recruitment or restoration planting occurs, and erosion would be short term and not substantial. Entrainment of sand from the littoral zone entering the lagoon inlet is discussed above in the context of the flood shoal that would develop between maintenance cycles. Alternative 1A would increase the stability of the lagoon inlet but the lagoon would continue to be a flood-dominated system. Sand would continue to enter the lagoon and accumulate into a flood shoal. Sand is relatively large in grain size, however, and typically settles out of the water column relatively quickly. The inlet channel between Coast Highway 101 and the railroad bridge would be protected with riprap along both sides, and would provide a discrete location for the flood shoal to develop without substantially affecting adjacent habitat areas. Shoals would be monitored by SELC on a semi-annual basis and removed during regular maintenance or as-needed (PDF-31). **Impacts to flooding, erosion, and/or siltation would be less than significant (Criterion C). No substantial adverse impacts would occur.**

Alternative 1A would provide limited flood reduction potential compared to existing conditions. Although the lagoon channel network and infrastructure improvements would enhance hydraulic connectivity between the lagoon and ocean and allow fluvial flows to drain from the lagoon more efficiently, physical constraints with the existing inlet (i.e., long, sinuous, and narrow/shallow channel) would limit flood elevation reductions that can be realized. As shown in Table 3.2-2, Manchester Avenue would continue to be under 100-year flood elevations in three locations within the east basin (East Basins 2, 3, and 4), although overall flood elevations in that location would be reduced from existing conditions. No increases in 100-year flood elevation of more than 1 foot would occur. No residences or additional structures would be at risk for flooding under the 100-year storm event. Channel and infrastructure improvements would be reviewed by the County, Caltrans, the City of Solana Beach, and the City of Encinitas, as appropriate, prior to approval of project grading plans (PDF-40).

Coordination with the City of Encinitas and FEMA representatives has indicated that the LOMR would be provided after construction is completed and would be filed to formally modify the FIRM, or Flood Boundary and Floodway Map (FBFM), or both (PDF-39). This alternative would not require a CLOMR, which is needed if a proposed project causes an increase in flood elevation of greater than 1.00 foot and is within a flood area designated as Zone A. **No substantial adverse direct or indirect effects to flooding or other hazards have been identified associated with implementation of Alternative 1A. Impacts would be less than significant (Criterion D).**

No Project/No Federal Action Alternative

Under the No Project/No Federal Action Alternative, tidal flows would continue to be restricted due to the narrow and meandering channel between Coast Highway 101 and the railroad, and the presence of a sill underlying the inlet. Tidal ranges would continue to be muted for both high and low tides, while progressively increasing from the west basin through the east basin. As a result, poor lagoon circulation (i.e., tidal exchange), surface water drainage, and flood protection would remain the same as current conditions if no alternative is implemented. There would be no change to surface runoff. No changes to groundwater interaction would occur.

The No Project/No Federal Action Alternative would maintain flood elevations along the east basin and Manchester Avenue that exceed the road elevation by several feet (Table 3.2-2). However, this is no change from existing conditions; therefore, no additional impact would result to the potential for exposure of people or property to water-related hazards such as flooding. Under the No Project/No Federal Action Alternative, the condition of stormflows being retarded by constricted channels and bottlenecks under Coast Highway 101 and the I-5 bridges would continue, thus elevating water levels more than would occur with restoration. If the I-5 bridge is replaced and the lagoon is not restored, then it is expected that stormflows would drop in elevation east of I-5, but would rise west of I-5.

There is no change from the No Project/No Federal Action Alternative to the potential for erosion and siltation. The lagoon would continue to have restricted circulation due to the hydraulically inefficient channel system with several choke points in the system. In addition, annual maintenance would be required to remove the accumulated flood shoal and keep the inlet open. **No substantial adverse effects would be anticipated under the No Project/No Federal Action Alternative, and impacts would be less than significant, although benefits associated with the build alternatives would not be realized (Criteria A through D).**

3.2.4 Avoidance, Minimization, and Mitigation Measures

Given the compliance with required stormwater permits, as well as conformance to proper BMP design, implementation, and maintenance mandated by permits and associated regulations, no significant or substantial adverse impacts to hydrology would be expected as a result of SELRP implementation. No mitigation measures are required.

3.2.5 Level of Impact After Mitigation

CEQA conclusion: Impacts to hydrology would be less than significant due to implementation of the SELRP.

NEPA: No substantial adverse impacts to hydrology have been identified due to implementation of the SELRP.

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